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ABSTRACT

Existing instruments for assessing brain damaged physically handicapped children are examined, and research on test modifications in the cognitive, communication, and motor performance domains is reviewed. Noted is the lack of tests standardized on a physically handicapped population. Cautions and criticisms are cited for modifications which have tended to involve adaptation of the presented stimuli or the child's response mode. Suggestions are given for dealing with the effects of motor impairments (such as placing the spastic child in a side lying position to encourage manipulation of objects), and characteristic perceptual difficulties of cerebral palsied children are described. The appropriateness of six commonly used instruments (including the Columbia Mental Maturity Scale) is discussed. Considered are variables in the areas of communication (such as oral motor skill and abstraction abilities), motor development (including postural patterns), and testing situations (such as subtle changes in muscular tension in response to stimuli). (CL)

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FUNCTIONAL ASSESSMENT OF THE BRAIN DAMAGED PHYSICALLY HANDICAPPED CHILD: COGNITIVE, COMMUNICATION, AND MOTOR VARIABLES

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Functional Assessment of the Brain Damaged Physically Handicapped Child:

Cognitive, Communication, and Motor Variables

Intelligence does not grow automatically but is dependent upon two factors: an inner drive or motivation and opportunities to interact with a stimulating environment. Although the motivation exists within many physically handicapped children, for those who spend the majority of their day in a wheelchair or bed the opportunities to experience cause-effect relationships within their environment are severely limited. Just as sensory deficits block channels for taking in experiences, motor disabilities often inhibit physical exploration.

When sensory and motor impairments interfere with one's ability to experience and communicate with his environment, opportunities to develop intellectual potential are limited. Thus, when attempting to obtain an objective evaluation of the cerebral palsied child's mental ability, one is confronted not only with a child whose experiential opportunities have been limited but also with a child whose physical impairments contribute quite heavily to the difficulty of the task (Blum, Burgmeister & Lorge, 1951). The examiner testing the physically handicapped child must be aware of the physical factors involved in order to efficiently and effectively administer the tests. He may test a child not only whose speech is unintelligible, if present at all, but who may be unable either to maintain an erect posture, control hand or arm movements, or manifest intact visual, auditory, or tactual processes. To obtain a severely physically handicapped child's maximum competency level, the examiner must be aware of the problems inherent in existing instruments when applied to this population as well as of the effects the impairments impose on the child's performance in a testing situation. Equally important to the testing milieu is an awareness of available instruments adaptable to the physically handicapped and their

advantages and disadvantages, The examiner must be adept in facilitating the child's optimum response while simultaneously exerting caution regarding his own set of cues. The purpose of this paper is to familiarize the reader with the available instruments used in testing the physically handicapped child and procedures for adapting items to obtain the child's maximum functional level in cognitive, communication, and motor domains.

Existing Tests

Traditionally, physically handicapped children have been evaluated with instruments standardized on children who have learned the desired responses from their interactions with their environment. These tests have typically been unsuitable to the child's handicap, requiring fine motor manipulations, verbal analogies, and imposed time limitations. Sattler and Tozier (1970) reported that scores derived from standardized administrations of traditional tests reflected the severity of the impairment rather than the child's intellectual capacity. Contrary to Freedheim (1966), Russ and Sobcloff (1958) and Sievers (1950), Sattler (1972) found initial assessment of physically handicapped children to yield reliable results. Sattler found no correlation between the extent of the child's physical disability and I.Q. of children between the ages of two and five years although low mental ages in older children correlated significantly with speech and walking disabilities. Similarly, Sattler identified a high correlation between children's visual and arm and hand abilities and sitting balance.

Although tests have been developed with physically handicapped children in mind (Burgmeister, Blum & Lorge, 1954; Dunn, 1959; French, 1964; Haeussermann, 1958; and Zimmerman, Steiner & Evatt, 1969) only one, located in the literature, has been standardized on this population (Irwin & Hammill, 1969). Tests

frequently administered to physically handicapped children include the Ammons and Ammons Full-Range Picture Vocabulary Test, Peabody Picture Vocabulary Test, the Pictorial Test of Intelligence, the Ravens' Progressive Matrices, the Vineland Social Maturity Scale, the Columbia Mental Maturity Scale, and the Illinois Test of Psycholinguistic Abilities (Bice & Cruickshank, 1966). Allen and Jefferson (1962) listed the Leiter International Performance Scale, the Gessell Preliminary Behavior Inventory, the various forms of the Stanford-Binet, particularly Katz's pointing scale (1956), the Wechsler Intelligence Scale for Children, and the California Picture Information Test as other instruments used with this population. Rosenfield (1952) used the Cattell Infant Scale of Intelligence while Dunn & Harley (1959) included the Van Alstyne Picture Vocabulary Test in a battery of tests administered to cerebral palsied children.

Johnson (1966), French (1964), and Williams (1966) all refer to the impossibility of constructing a test for cerebral palsied children because their individual limiting impairments are incomparably diverse. French (1964) decided not to use cerebral palsied children in a standardization sample because he felt that no two children could be identically impaired. Yet, in the Pictorial Test of Intelligence (PIT) manual French describes three cerebral palsied children to whom the PIT was administered, all of whom were nonverbal quadriplegic.

Modifications

Efforts to adapt available testing measures for physically handicapped children have been widely initiated. Sattler (1972) delineated stimuli and response as the two general modifications made in test administration, the adapting of the stimuli being the most difficult while adapting of the response mode least effects reliability and validity. Evaluator's frequently rely on their own

their own judgement in modifying testing items, and may, in fact, be creating their own test by changing the content of the stimuli.

Modifications of standard testing instruments have included eliminating subtests requiring physical abilities not within the repertoire of the handicapped child, inserting multiple choice answers, pantomining or pointing to responses, steadying the involved hand, and enlarging the actual testing materials (Sattler & Tozier, 1970; Bice & Cruickshank, 1966; Anastasi, 1968; Irwin, 1972; and Katz, 1956). Allen and Jefferson (1962) suggested that the examiner point to the choices or ask questions and the child indicate his response by some prearranged signal. Signals have consisted of visual or auditory patterns of eye blinks, coughs, taps, etc. The child functioning on a low level may experience some confusion in understanding such a coded system with his scores reflecting this lack of comprehension. The aforementioned signalling responses aside from being fatiguing for the child, are often either unintelligible to the examiner or most difficult to distinguish for the purpose of interpreting the response the child is attempting to make.

Modifications, however, have evoked concern and criticism. Until Sattler's thorough modification of the Stanford-Binet (1972) the two outstanding criticisms of adaptations were that studies failed to compare handicapped and non-handicapped groups and that reliability and validity measures were affected. Newland (1963), Anatasi (1968), Staller and Tozier (1970), and Katz (1956) have expressed concern over the modifications in that they create difficulties in the use of test norms for the handicapped population. Sattler and Tozier (1970) emphasized that "no testing is valid if it is so unique that it cannot measure a child in an accepted standardized normative range of mental development" (p. 394). Anastasi (1968), in particular, found normative and validity figures for such

adaptations to be meager. The adaptations have not been standardized on nonhandicapped populations, nor has a repeated measures design been utilized (Kattler & Anderson, 1973). Katz (1956) stated that reduction of the number of items lowers reliability and increases probable error of findings from such an abbreviated score by 20 percent.

Hohman (1958) suggested using necessary test adaptations and prorating the scores. Alerting other examiners to the caution with which prorating must be handled, Hohman warned "... this procedures is widely accepted and recognized as adequate if the examiner is duly careful" (p. 96). Quite opposed to adaptations of testing instruments used with handicapped children Kogan (1957) cautioned against the omission and adaptation of test items. He maintained that a realistic evaluation of the way in which a child functions when compared with his healthy peers of the same age must be derived. Even with adapting and omitting items in accordance with the child's individual needs, examiners have found from five to thirty percent of cerebral palsied children to be untestable (Munksgaard, 1962; Kogan, 1957; and Hohman, 1958). Johnson (1966) emphasized that valid assessment instruments devised to ascertain the cognitive functioning of a cerebral palsied individual must be standardized on that specific population with "separate and distinct norms derived from that universe" (p. 29).

Effects of Impairments on Performance

The evaluator should be sensitive to problems characteristic of brain damaged physically handicapped children in a testing situation. Spastic children exhibit more control when placed in a relaxation chair that facilitates flexion of the legs and inhibition of extension thus allowing the child freedom to use his arms in midline. An excellent way of permitting the spastic child to see and manipulate objects spontaneously is by placing him in a side lying position

in which his knees are flexed and supported with a pillow. Often in an upright position the asymmetrical tonic neck reflex (ATNR) prevents a spastic child from raising his head without an extensor thrust reaction of the arms and many children are unable to break the total pattern to use their arms effectively. The child retaining the ATNR cannot grasp objects when looking at them, the arm on the side to which his head is turned extends while the other arm flexes. The only way the child can grasp the object is by turning his head to the other side to effect the reciprocal reaction. While the spastic child experiences difficulty in releasing objects, the athetoid child has trouble in grasping them. His aim in pointing is wavering and uncertain and head control is minimal. This child may work better when inclined on a prone board or laid over a bolster large enough to permit extension of his arms over the edge. The eyes of the spastic child may be fixed in the direction of the ATNR while they eyes of the athetoid child often exhibit nystagmus; both children are frequently incapable of giving accurate or reliable eye-pointing responses. Similarly ataxic children find focusing on objects or drawings over an extended time extremely uncomfortable and often nauseating. These children fatigue easily as they expend so much energy in responding. Haeussermann (1958) stated that the involuntary motion and vagueness of such children in approaching a correct choice may appear to an inexperienced examiner as an inability to decide between choices or as an intentional ambiguity.

Cruickshank (1966) and Munksgaard (1961) found a high percentage of cerebral palsied children to manifest disturbed perceptual mechanisms, particularly those regarding figure-ground relationships and the ability to perceive a gestalt. The lack of the brain damaged child's stability of figure-ground separation results in failure to isolate relevant from irrelevant cues. Similarly these

children experience difficulty in figural discrimination and visual closure skills. Mecham, Berko and Berko (1960) reported that brain-damaged children demonstrated ten times the errors on the Sequin formboard as did normal children.

Miller and Sethi (1971) and Parsons (1972) presented evidence indicating a high degree of visual perceptual disabilities in children with hydrocephalus. Miller and Sethi reported that hydrocephalic children received lower scores on performance than on verbal items of the Wechsler Intelligence Scale for Children, attributing the discrepancy to disturbed visuospatial relationships. In a study conducted by Miller and Sethi, fourteen children manifesting hydrocephalus were administered the Bender Visual Motor Gestalt Test and the Frostig Developmental Test of Visual Perception. Significant differences found in chronological age and the age quivalents achieved on the tests indicated two primary areas of disability. The children were discovered to have an inability to perceive presented shapes in their totality and to ignore irrelevant aspects of the total stimulus display. Two separate tests lacking fine motor skills were designed by Miller and Sethi to futher assess these impairments. Compared with a matched age group, the hydrocephalic children preformed significantly lower than their normal peers on the tests involving perception of visuospatial relationships.

Parsons (1972) noted that hydrocephalic children achieved low scores on spatial ability tests and were slow and hesitant in pegboard tasks. Although slow in simple routine clerical skills, hydrocephalic young adults were accurate, exhibiting difficulty with visuospatial and manipulative skills.

Shurtleff (1966) presented literature suggesting that children deprived of an erect posture in the ages from three to eighteen months manifested delayed acquisition of reading and writing skills. The children were reported to

confuse right from left, exhibit difficulty in distinguishing "d" from "b" or "E" from "3", and to demonstrate spatial disorganization. Mecham, Berko and Berko (1960) stated that active motor experiences heighten awareness of visual cues.

Cotton (1941) found that cerebral palsied children exhibited a compulsiveness to react to stimuli and demonstrated responses which were stereotyped in nature and of varied individual differences within a specific testing situation. Cotton (1941) and Mecham, Berko and Berko (1960) felt that the most classic sign manifested by the cerebral palsied child during psychological testing, was his tendency toward concrete responses with decreased ability to shift to more abstract forms of behavior. Extremely rigid in their concept formation, brain damaged physically handicapped children experience problems in categorization processes. They are unable to discriminate central from incidental characteristics and manifest difficulties in the organization and integration of information to generalize across categories. They lack the ability to shift procedural orientations and perseverate on methods and responses effective with previous problems. Physically handicapped children often display long delays between the stimulus and their response and the examiner should be cautious in mistaking this delay as lack of response. Timed items, part-whole associations, missing elements, and similarity tasks are extremely difficult problems for these children to solve.

Appropriateness of Commonly Used Instruments

Recognition of the frequently encountered problems of the physically handicapped child is important to the selection of appropriate tests. Until the development of the Columbia Mental Maturity Scale (CMMS) by Burgmeister, Blum and Lorge (1954), no instrument was available for measuring intellectual

functioning of children between 3 and 9 years possessing combined manual and verbal difficulties. Since its development, the CMMS has received criticism by Canter (1956), Berko (1955), and Sattler and Tozier (1970). More prominent among the criticisms have been complaints that the CMMS stresses visual perceptual discrimination and categorization abstraction which are abilities commonly impaired in brain-injured children. Canter (1956) lists other major limitations to the CMMS which include the tendency of cerebral palsied children to perseverate on the position of the items on the cards, the arrangement of difficulty of the various cards, and the shifts in the kinds of concepts involved in comparisons required. The CMMS is only one of the tests designed to require non-motor and nonverbal responses that are primarily composed of form matching, discrimination, and matrix completion items. Ravens' Progressive Matrices (Ravens, 1947) are similarly composed and require part-whole association skills to accomplish the matching tasks. Also requiring only a pointing response, the Full Range Picture Vocabulary Test (Ammons & Ammons, 1948) along with the Ravens and CMMS contain perceptually confusing details. The examiner should distinguish between errors of visual perception and of perceptual motor. A viable instrument for this purpose is the Motor Free Visual Perception Test (Colarusso & Hammill, 1972). This test is applicable to children between five and seven years of age and taps visual discrimination, closure, figure-ground, and memory abilities through only a pointing response.

The only test ever standardized on a group of cerebral palsied population, Irwin and Hammill's Abstraction Test is adaptable to a pointing response. Items tapping sequential, coordinate, and mixed categorization and abstraction abilities are presented orally. The child is read a stimulus item and asked to discriminate the difference or similarity of an analogy.

The two instruments which have offered the most comprehensive assessment of the physically handicapped child are Haeussermann's Developmental Potential for Preschool Children and French's Pictorial Test of Intelligence. Haeussermann's manual suggests many interesting and useful ideas for specifically determining where a child from two to six years is functioning in the areas of language, recognition of pictorial materials, perception, differentiation, and memory of basic symbols, concepts of amount and visual-spatial orientation. Requiring only an eye-pointing response, the Pictorial Test of Intelligence (French, 1964) assesses abilities of children from three to eight to identify picture vocabulary, discriminate forms, comprehend size and number concepts, recognize similarities, recall and comprehend general information, and remember visual stimuli.

For the child from three to nineteen years Leland and Baker (1959) designed the Detroit Tests of Learning Aptitude, suggesting subtests administerable to deaf, blind, and physically handicapped children. Subtests applicable to a pointing method include pictorial absurdities, pictorial opposites, and visual attention span for objects and for letters.

Katz (1956) and Sattler (1972) have both adapted the Stanford-Binet for physically handicapped children. Sattler presents a much more comprehensive instrument and also adapted coding, digit span, and block design items from the Wechsler Intelligence Scales for Children. Interestingly, the children to whom Sattler adminstered the adapted items performed much more efficiently on the Stanford-Binet tasks.

Communication Variables

Meeham, Berko and Berko (1960) viewed the problems of abstraction and categorization as basic linguistic problems affecting the child's concept develop-

ment. Suggested was careful observation of quantitative concepts, concepts of comparison, and of vocabulary to determine whether the child has the basic raw materials essential to the development of abstraction abilities.

Swisher and Pinsker (1971), Laurence (1971) and Parsons (1968) all reported the prevalence of the "chatter-box" syndrome or the "cock-tail party" syndrome which is characteristic of the language abilities of hydrocephalic children. Their speech is often delayed until two and a half years, after which their output increases rapidly. The general concensus concerning their language development is that hydrocephalic children are hyperverbal, enjoy imitating, learning and using new words. Their speech, however, is lacking in content and their words are frequently used illogically. Congruent with their language abilities, hydrocephalic children read fluently but lack comprehension abilities (Parsons, 1972). They learn poems and songs easily and do well on intelligence tests involving items in which they recall simple sentences or a series of digits. When compared with their normal peers on a word-phrase recall test, hydrocephalic children evidenced no significant difference in short term memory abilities (Parsons, 1969).

Spain (1972) and Parsons (1968) found hydrocephalic children to demonstrate well developed rules of syntax and morphology but their ability to use language meaningfully was not as well developed. When based only on verbal output, the intellectual potential of these children is often overestimated. They do well repeating stories from memory but cannot explain them. They perform well on picture vocabulary items but fail on verbal tasks requiring reasoning and comprehension. The average scores of hydrocephalic children on the Illinois Test of Psycholinguistic Abilities (ITPA) are lower than those of their normal peers. Younger children in particular demonstrate impaired abilities on

auditory association and auditory reception subtests. Swisher and Pinsker (1971) reported that hydrocephalic children express greater amount of wrong responses rather than a greater amount of words on intelligence tests. They verbalized irrelevant guesses when they were unfamiliar with the answers, this behavior being most prominent during times of stress.

The damage to the brain affecting gross motor coordination also affects the finer muscles of the oral musculature and the diaphragm. These muscles are often paralyzed or are incapable of proper coordination for speech and the child has difficulty sustaining an air stream, thus manifesting dysarthric or apraxic speech. The tongue tips sounds /d/, /t/, and /l/, are difficult phonemes to produce as are /f/, /s/, and /ʃ/, requiring fine coordination between the oral musculature and air propulsion. Cerebral palsied children tend to produce phonemes in the easiest manner possible and use this production continually even though they can do better. Their speech is characterized more by omissions than by distortions as final phonemes are more difficult to sustain or produce. They are prone to using one syllable words and only those words containing phonemes easiest to form. Quite frequently their voice quality is harsh as a result of paralyzed vocal cords. Because they often compress their expressive productions to convey only the most meaningful words, assessment of their receptive language is frequently a more valid indicator of their language abilities.

While the Peabody Picture Vocabulary Test (Dunn, 1959) requires only a pointing response, it assesses only vocabulary and does not allow for a global view of the child's language competency. The most comprehensive and appealing test of language development functional with physically handicapped children is Carrow's Test of Auditory Comprehension of Language. The instrument requires only a pointing response and is designed in a simple format of three,

up-to-date pictures to a page. Normed on children from three to seven, the test surveys morphological, semantical, and syntactical structures. Similarly designed is Lee's Northwestern Syntax Screening Test (1969). Comprised also of an expressive component, the Northwestern requires only a pointing response on the comprehension segment. Developed primarily to screen the child's syntactical repertoire, the Northwestern also provides information regarding semantics and morphology. The BOEHM test of Basic Concepts (Boehm, 1969) and the Basic Concept Inventory (Englemann, 1967) are excellent screening instruments useful in determining whether the preschool child has acquired essential memory and language concepts of space, quantity pronouns, prepositions, and tense formation. These tests have clear simple line drawings and are easily adaptable to a pointing response. Zimmermann, Steiner, and Evatt (1969) designed a language test assessing receptive and expressive language in the child from 18 months to seven years to be applicable to the physically handicapped child. The instrument requires several fine and gross motor manipulations and manifests a tendency to tap conceptual rather than language skills. Irwin (1956) designed a set of four short consonant and one vowel scale to measure the phonetic articulatory skills of cerebral palsied children. The child is asked to repeat words read to him by the examiner rather than having to identify pictures.

Motor Variables

While the physical therapist should maintain primary responsibility for the physically handicapped child's motor development, the examiner should be aware of the child's functional abilities. Awareness of the type and strength of muscle tone and the manner and extent of body parts involved will help the examiner decide on the type of response mode that will be the most efficient. Observation of any pathological patterns of posture and movement and the effect of contractures or deformities on the child's ability to support himself, use

his hands in midline, and bring his hand to his face or mouth are important in making decisions about educational procedures which will best facilitate the child's cognitive-adaptive development. The type of orthotic appliances and the child's ability to use them for independence should be evaluated in terms of daily living skills. Fiorentino (1970) and Semans, Phillips, Romanoli, Miller, and Skillen (1965) have designed excellent instruments in helping the teacher or psychologist look at motor abilities in physically handicapped children and the effects these impairments impose upon developmental milestones. Unique procedures for assessing gross and fine motor development in physically handicapped children are proposed by Johnson and Zuck (1961).

Testing Variables

The examiner entering into a testing situation with a physically handicapped child should first ensure that the child has a stable basis of support and is placed in a position which allows maximum range of motion. Next the child's response mode should be determined. Responses may range from a manual pointing or eye pointing to a yes-no format. Spacing two or three stimuli far apart facilitates a looking response which is more reliable than a yes-no answer. The child's response of a yes or no may consist of his raising his eyes for yes and lowering them for no, shaking his head for yes and remaining still for no. Positive responses to the examiner's pointing to the possible solutions may be indicated by the child's blinking his eyes, exerting random purposeful movement, or manifesting a gross motor movement such as raising his arm or kicking his leg. Adapting solutions to a language board may prove an efficient way for assessing a higher functioning physically handicapped child. Because yes-no answers are subject to chance, items should be administered several times to obtain a reliable response. The examiner must continually be aware of the delayed response characteristic of these children and exert

patience in waiting so as to ensure the child time to respond.

Responses from a severely physically handicapped child functioning on a low level are not as overt as a yes-no answer and the examiner must be sensitive to subtle changes in muscular tension, cessation of crying or activity in response to a stimulus, or an alteration in the general responding pattern. The examiner must exert extreme caution in interpreting these signs, particularly when the examiner must physically guide the child or respond himself to an item from gestural directions given by the child. Careful analysis of sensory-motor behaviors and the stages designated by Uzgiris and Hunt (1975) is essential in determining functioning levels of low functioning physically handicapped children. Examples of responses within the sensory-motor framework are the child's looking down into a box previously filled with tiny objects and exhibiting a surprised or puzzled expression, looking first at a block and then at the cup until the examiner has filled the cup, and opening his mouth when approached with a spoon but turning his head when approached similarly with a shoe. Rather than having him grasp a solid, narrow rattle, small pliable squeeze toys are much more compliant to contact. Encouraging a child to tap or swipe at a musical roly-poly toy to demonstrate purposeful movement requires a minimum of physical ability as opposed to having the child hold and shake a bell. After a child's intent is clearly conveyed, the examiner may assist the child in completing a motor task but he must use discretion in his interpretation of the response.

Assessing the physically handicapped child is a most challenging and subjective task. The examiner who is familiar with the characteristics associated with the performance of these children and how those characteristics can impose limitations on the appropriateness of existing tests can successfully

obtain a range of the child's furctional abilities. The examiner's effectiveness in testing physically handicapped children is affected only by his powers of ingenuity and observation.

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